

NOTES ON THE PLANKTON OF LONG LAKE, DADE COUNTY, FLORIDA, WITH DESCRIPTIONS OF TWO NEW COPEPODS¹

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The flat southern tip of the Florida peninsula, because of the low altitude and poor drainage of the area, contains many lakes. Lying between the lakes are large areas of swamp and marshland, more or less inundated during the rainy season. A considerable portion of this area is incorporated in the new Florida Everglades National Park.

A ridge of limestone a few feet higher than the surrounding territory forms a rim along the eastern and southern portions of the Everglades, and on this rim are built the cities and towns of the region. In its southern portion this rim curves inland and is some distance from open water. The land south of the rim lies so low that much of it is influenced greatly by salt water from Florida Bay or from the Gulf of Mexico. A great deal of the area south of the limestone rim is a vast mangrove swamp, with many brackish lakes among the mangroves, connected to open salt water through narrow tidal passages.

Most of these lakes are inaccessible except by skiff, and for the most part are less than six feet in depth. Practically no biological work of any kind has been conducted on them, nor on similar lakes elsewhere in the world. J. H. Davis (1940: 369-370) is the only writer to mention plankton in the area, and he does so only in the most general terms: "Myriads of small crustaceans and protozoans thrive in the plankton and soils of the swamps. Locally foraminiferan shells are abundant in the bottom deposits." He, however, deals primarily with the non-lacustrine flora as is also true of his valuable work (1943) on the natural features of Southern Florida. Henshall (1889) studied fish in Florida Bay, but did not approach the lakes presumably because of shallow water conditions. He does, however, report some species from Cape Sable Creek. Among the rare direct references in scientific accounts to the lakes themselves is Carr (1940: 69) who refers to crocodiles and alligators in the West Lake area. Immediately to the north of the area, Safford (1917) studied Royal Palm State Park and vicinity, but he

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only mentions the mangrove area in passing. His map shows West Lake and Lake Ingraham, but none of the others. Indeed, his Ingraham Highway is shown passing through Long Lake! In addition, there are a very few individual records in general works of the occurrence of certain species. One of these is Rathbun (1930), who refers to *Callinectes sapidus* (a decapod crustacean) from Cape Sable Creek. Botanists and zoologists from the University of Miami and elsewhere have visited the area from time to time in search of orchids, termites, etc., and naturalists such as Simpson (1920) have written popular accounts of certain striking features, but on the whole extraordinarily little has been published on the area.

Long Lake, in Dade County, lies approximately 12 miles southwest of Royal Palm State Park, and is about one mile as the crow flies from Garfield Bight, a shallow arm of Florida Bay. However, the lake is connected with Garfield Bight by a narrow and devious passage four miles long. Long Lake is depicted on U.S. Coast and Geodetic Survey Chart 1250. It is about 1.8 miles long and 0.4 miles wide at the widest point. Small islands nearly cut off the narrower eastern end of the lake from the wider western end, but these islands are not accurately shown on chart 1250. In the parts of the lake visited, the depth was not more than four or five feet.

On June 29, 1947, a plankton tow was obtained in Long Lake, using a standard open plankton net of No. 12 silk bolting cloth. Similar tows were obtained from West Lake and from Garfield Bight. West Lake, however, contained innumerable Ctenophora, and these clogged up the nets and slimed the sample to such an extent that practically no other organisms were captured. The species of Ctenophora could not be determined. It was not possible to return living samples to the laboratory, and preservation was unsuccessful. The majority belonged to the class Nuda, but some small forms were noted with tentacles. These were probably immature specimens. The analysis of the tow from Garfield Bight will not be reported upon at this time.

The water of Long Lake was of the red color typical of mangrove swamp water. The water was distinctly brackish in spite of the fact that the preceding month of June had an exceptionally high rainfall in the Everglades region. The marine plankton forms present make it appear doubtful that the lake ever becomes completely fresh. An analysis of the water kindly performed by Dr. Robert H. Williams of the Marine Laboratory staff showed a salinity of $15.39^{\circ}/_{\text{o}}$ (West

Lake, which is a larger body of water had a salinity of $18.30^{\circ}/_{\infty}$ and Garfield Bight $26.87^{\circ}/_{\infty}$.

The plankton sample was especially interesting, showing as it did a mixture of marine and fresh water types. Of the plants, small naviculoid diatoms were numerous, and the marine dinoflagellate *Ceratium furca* was also evident, although not at all abundant. Of the animal forms, various Foraminifera were found, as well as rotifers, brachyuran zoeæ, and fish eggs. Ctenophora such as those found in West Lake were also observed in the water, though they were by no means as abundant as in that location. The above animals, except the rotifers, are typical of marine or of brackish water situations.

By far the dominating organisms of the sample, however, were the Copepoda. It is estimated that in ten minutes of towing with a 12-inch net approximately 18,000 were captured. Three species were obtained. About 95 per cent of the copepods represent a new variety of *Cyclops panamensis*, a fresh water species heretofore reported only from the Pacific side of the Panama Canal Zone. For the most part the genus *Cyclops* is characteristic of fresh water, though some species occur also in brackish water. The second most abundant species of copepod, comprising essentially the remaining five per cent, was a hitherto undescribed species of the genus *Acartia*. The genus *Acartia* is found only in marine and brackish waters, and for the most part it is characteristic of coastal and inland waters, rather than the open sea. A third species was found only in small numbers. It is apparently identical with *Pseudodiaptomus coronatus* Williams. *Pseudodiaptomus* is a genus that is considered by Marsh (1933) and most other authors to be actively in the process of migration from salt water to fresh water. Some species are found only in salt water, some only in brackish water, and still others only in fresh water. The last, however, are found only in fresh waters closely associated with the sea.

Copepod nauplii were not at all abundant in the sample, but most nauplii would be sufficiently small to pass through the No. 12 mesh net used. It is evident, however, that very large numbers of small nauplii were living in the water for nearly one-third of the numerous individuals of the *Cyclops* were ovigerous females. The eggs in the egg cases were well developed, many of the egg cases were empty, and occasional eggs had been preserved while in the process of hatching. The few specimens of *Pseudodiaptomus coronatus* females were likewise actively breeding, and many of the *Acartia* females were carrying sper-

matophores. Species of *Acartia* do not carry their eggs in egg sacs, but extrude them into the surrounding water.

Pseudodiaptomus coronatus Williams

This species was originally described from Rhode Island by Williams (1906), and has subsequently been reported from the Woods Hole area by Sharpe (1910), Fish (1925), and Wilson (1932b). It has also been reported from Nova Scotia by Willey (1923), from Chesapeake Bay by Wilson (1932a), and from the mouth of the Mississippi River by Wright (1936, 1937). The species is described as having four segments in the urosome of the female, with the line of demarcation between segments two and three somewhat obscure. In the Long Lake specimens the line of demarcation is all but obliterated. Also, in females the shape of the lips protecting the genital aperture differs from the figures given in the various publications. In the male the details of the arrangement of the spines and hairs on the fifth feet differs slightly from the published descriptions and figures (see Plate I, fig. 1), but these characters do not appear to be sufficient to establish a new species or variety.

Female specimens from Long Lake were from 1.23 to 1.33 mm. in length, while males were from 0.92 to 0.97 mm.

Acartia floridana n.sp.

DIAGNOSIS: *A. floridana* belongs to the subgenus *Acartiura* as established by Steuer (1915). It differs from all other known species in the combination of lack of rostrum and shape of female fifth legs, as well as in the structure of the male fifth legs. The type specimens have been deposited in the United States National Museum.

TYPE FEMALE (U.S.N.M. Cat. No. 84518): Size 0.80 (0.74 to 0.94) mm.

The head is rounded anteriorly, and there is no trace of rostral filaments (see Plate I, fig. 5). The last thoracic segment is rounded. The urosome consists of three segments, of which the genital segment is the longest, and the second segment the shortest. The furcal rami are only very slightly longer than broad, and each bears four sub-terminal setæ, and a fifth seta on the outer border. The spermatophore is small, being only slightly longer than the last two urosomal segments together (see Plate I, figs. 3-4).

The first antenna consists of seventeen segments, of which the fifth from the proximal end is very long, and obviously composed of at least three fused segments (see Plate II, fig. 6). The fifth feet are small and two-segmented. The basal segment is much broader than the second, and bears a strong seta on its outer margin. The terminal segment is similar to that of *A. tonsa*. At the base it is enlarged. Slightly more than half the distance to the distal end there is a ring of small teeth, distal to which the segment gradually tapers to a point (see Plate II, fig. 8).

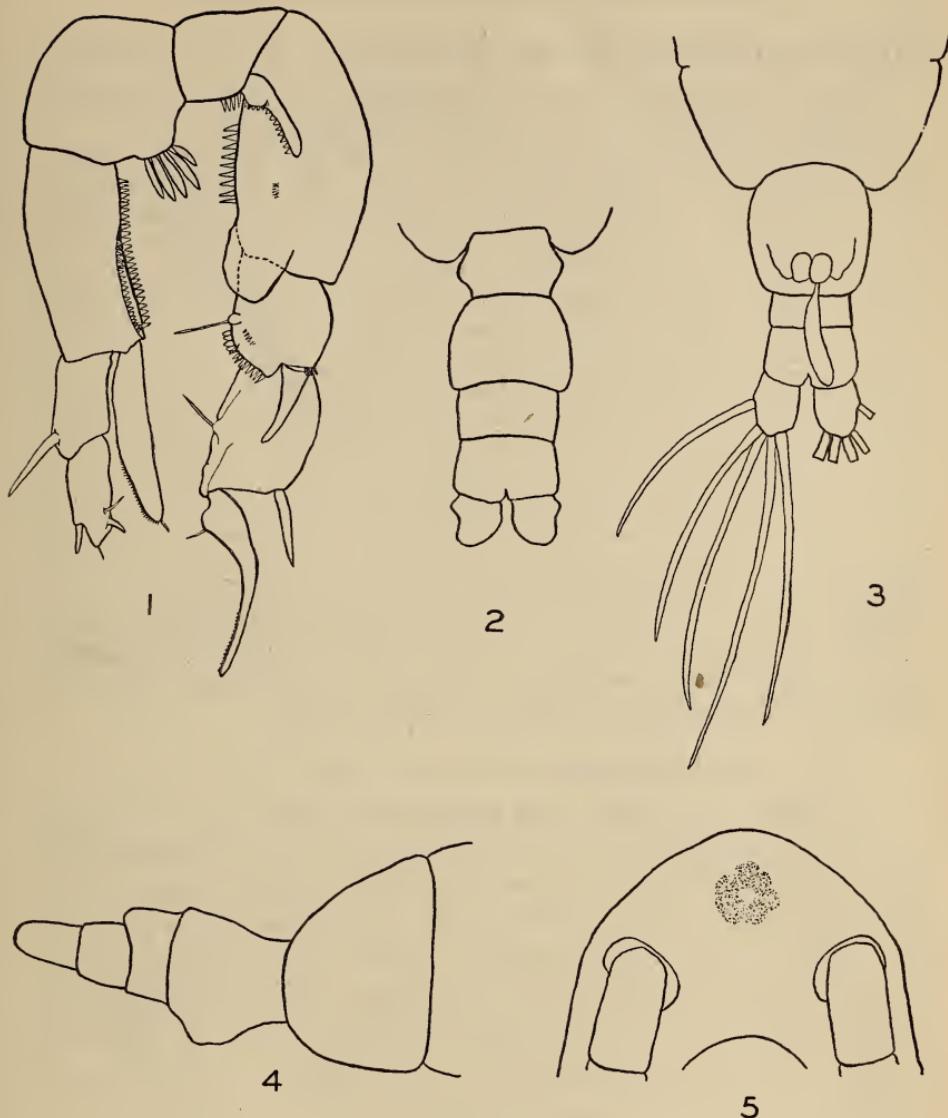


PLATE I

Fig. 1. *Pseudodiaptomus coronatus* Williams. Male fifth feet. $\times 325$.

Fig. 2. *Acartia floridana* n. sp. Male urosome, ventral view. $\times 200$.

Fig. 3. *Acartia floridana* n. sp. Female urosome and last segment of the metasome, ventral view. $\times 200$.

Fig. 4. *Acartia floridana* n. sp. Female urosome and last segment of the metasome, lateral view. $\times 200$.

Fig. 5. *Acartia floridana* n. sp. Female. Ventral view of anterior portion of the head $\times 325$.

TYPE MALE (U.S.N.M. Cat. No. 84519): Size 0.75 (0.70 to 0.85) mm.

The male is similar to the female, but the right antenna, which consists of 17 segments, is geniculate, with five segments distal to the geniculation (see Plate I, fig. 2).

The fifth feet are uniramous. The right foot consists of four segments. The first segment is short and very broad, being expanded on the inner margin. The second segment is relatively much narrower than either the first or the third, and it bears a hyaline protrusion in the middle of the inner margin. The third segment is approximately the same length as the second, but it is as broad as it is long, with a massive protrusion on the proximal portion of its inner margin. There is a fine hair near the base of the distal portion of the protrusion. The last segment is shaped somewhat in the form of a bird's head. It is somewhat longer than the other two segments. The inner margin is smoothly curved, and bears a small hair midway its length. The outer margin protrudes somewhat near the proximal end, and there is a second much larger swollen area midway its length. The segment ends in a small point. The left foot consists of three segments, of which the first is much broader than long. On its inner margin it bears an acute protruding lobe on the proximal portion, while the swollen outer margin bears a strong plumose seta. The second segment is about the same length as the first, but it is narrower than the other segments. There is a small spine, closely pressed against the segment, near the outer distal angle. The third segment is swollen proximally and tapers to a blunt point distally. There is a small spine near the middle of the outer border, and a second spine, somewhat longer and more closely appressed to the segment about three-fourths of the distance to the end of the segment. Finally there is a terminal spine, which is about the same length as the second spine, but is not appressed to the segment (see Plate II, fig. 9).

Cyclops panamensis Marsh var. *tannica* nov.

DIAGNOSIS: *C. panamensis* was described by Marsh (1913) from the savannas between Panama and Old Panama. It has not been reported from other locations, but has since been mentioned by Kiefer (1929). Specimens from Long Lake agree with Marsh's description except in the relative length of the urosomal segments in the female, the detailed structure of the fifth feet of the female, and in the proportions of the furcal rami and the arrangement of the setæ. In *C. p. tannica* the

PLATE II

Fig. 6. *Acartia floridana* n. sp. Female first antenna. $\times 80$.

Fig. 7. *Acartia floridana* n. sp. Male right first antenna. $\times 80$.

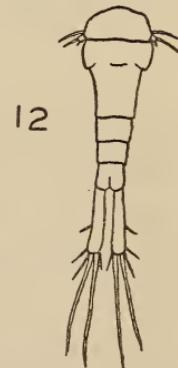
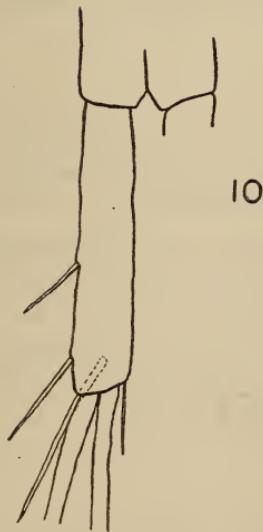
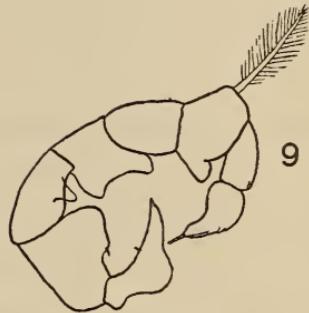
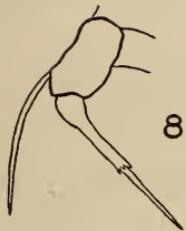
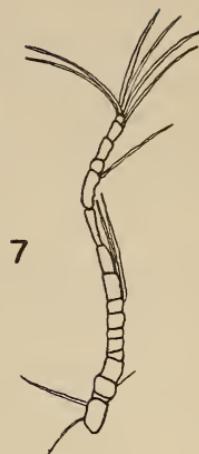
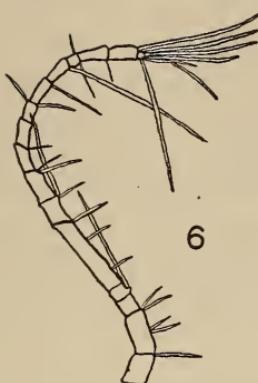
Fig. 8. *Acartia floridana* n. sp. Female fifth feet. $\times 325$.

Fig. 9. *Acartia floridana* n. sp. Male fifth feet. $\times 325$.

Fig. 10. *Cyclops panamensis* Marsh var. *tannica* nov. Female. Ventral view of right furcal ramus. $\times 325$.

Fig. 11. *Cyclops panamensis* Marsh var. *tannica* nov. Female fifth feet. $\times 325$.

Fig. 12. *Cyclops panamensis* Marsh var. *tannica* nov. Female. Ventral view of urosome. $\times 80$.



genital segment is more swollen anteriorly and is relatively longer than shown in Marsh's figures (see Plate II, fig. 12). The terminal spines of the fifth feet are wider apart in the new variety, and the terminal segment on which they are borne is truncate instead of indented (see Plate II, fig. 11). The furcal rami of variety *tannica* are somewhat longer than described by Marsh, and he describes four terminal setæ. In *C. p. tannica* there are two large terminal setæ and a third very thin and short one on the inner distal corner. A fourth seta arises on the outer margin a short distance from the distal corner. A fifth short seta, somewhat larger and longer than any but the two large terminal ones, arises on the middle of the dorsal surface near the distal end. Such a seta is not mentioned by Marsh. The sixth seta, on the outer margin, is similar in size and position to that described by Marsh (see Plate II, fig. 10). The type specimens have been deposited in the United States National Museum.

TYPE FEMALE (U.S.N.M. Cat. No. 84521): Size 0.80 (0.71 to 0.91) mm.

TYPE MALE (U.S.N.M. Cat. No. 84520): Size 0.74 (0.66 to 0.80) mm.

It was thought advisable to establish a new variety of *C. panamensis* for the Long Lake specimens. Minor structures were different, the habitat was different, and the geographic position was different. It did not seem necessary to establish a new species, at least until more collections have been made between Panama and Florida to establish whether the variations described are discontinuous or part of a series of continuous variations.

SUMMARY

A sample of the plankton from Long Lake, Dade County, Florida, was analyzed. There was a mixture of fresh-water, brackish water and marine forms. The dominant organisms were the Copepoda, of which three species were present. The commonest species of the Copepoda was a new variety, *Cyclops panamensis tannica*, which is described and figured. The second most abundant copepod was new, *Acartia floridana*, which is also described. The least common species was *Pseudodiaptomus coronatus* Williams, which heretofore has not been reported nearer than Chesapeake Bay and the mouth of the Mississippi River.

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